THE CORRELATION AND HOMOGENESIS OF PHYSICAL FORCES.

The following article, written by L'Abbé Moigno, was recently published in the London *Photographic News*:—

All the forces of nature—motion, heat, light, electricity, magnetism, chemical affinity—have intimate relations, or correlations with each other. These forces engender each other; so that, one being given, we can by putting it into action, produce all the others. This generation or homogenesis of the various forces by each other takes place in definite proportions, or according to the law of fixed equivalents; so that the quantity of any one of these forces expended in the act of generating another force is always represented by a corresponding quantity of the force engendered. Thus, for example, if, to create a mechanical force, we expend, without loss, the quantity of heat necessary to raise a kilogramme of water one degree of heat, the mechanical force produced will be capable of raising, in a second of time, 427 kilogrammes to the hight of a meter; and reciprocally, if, to produce one degree of heat, we expend the force capable of raising a meter in hight, in one second, a weight of 427 kilogrammes, the quantity of heat engendered will be that necessary to communicate, and will suffice to communicate to a liter of water one degree of temperature. M. de Beaumont's machine admirably demonstrates this fundamental principle, which will receive its full development when science shall have become able to define and accurately determine the mechanical, thermal, photogenic, electric, magnetic, and synergic equivalents, as clearly and accurately as it has arrived at determining the chemical equivalents of various simple and compound substances.

But this is not all. In making another step in advance, we have established, as a certain proposition, that the generation or homogenesis of the various forces nature is accomplished by areal transformation of one into another; so that, for example, heat, under given conditions, is transformed into a motive power, into light electricity, magnetism, and chemical affinity; or rather, becomes motive power, light electricity, magnetism, and chemical affinity. The beautiful experiment of Faraday, completed and fully developed by Foucault, of a cube submitted to rapid motion becoming hot when this motion suddenly stopped, is the sufficient and certain demonstration of the transformation of the quantity of motion into the quantity of heat—a transformation regulated by the principle of equivalents. At length we arrive at the theory or metaphysical reason of these intimate relations of the homogenesis, of these mutual generations or transmissions, always obeying the laws of equivalents. Our profound conviction is, that Mr. Grove and M. Seguin are perfectly correct when they assert that in nature there are only two things, matter and motion; matter under two forms and submitted to the law of universal attraction; motion once impressed on matter, which cannot augment either in its quantity or in the sum of its active forces, which may be successively transformed and modified.

When a ray of light falls upon a daguerreotype plate, forming part of a galvanic circuit which includes a galvanometer and Breguet's metallic thermometer, there is instantaneously and simultaneously produced chemical affinity on the surface of the plate, an electric current in the galvanometer, an elevataion of temperature in the thermometer, motion in the two needles of the galvanometer and thermometer, &c. As a concrete and striking example of homogenesis, we may instance what we will term the human machine, that masterpiece of creative power. It is sustained solely, first by alimentary provision, composed of carbon, hydrogen, nitrogen, and assimilative mineral principles, then by atmospheric air introduced by respiration. The vital phenomenon, *par excellence*, is the combustion of carbon and hydrogen by the oxygen of the atmosphere—a combustion which, it appears to us, is summed up in a first disengagement, in a first motion, in a first circulation of μ. Now, observe to what this first motion gives birth: a very intense heat, which maintains our whole body, even in winter, at a temperature of 98° Fah., an electric or nervous current, of which M. Helmholtz has established the existence and measured the velocity; the circulation of the blood in the entire system of arteries and veins; a mechanical force sufficient to transport the entire body which, upon an average, weighs 160 lbs., with a velocity of several yards per second; the muscular force exercised by the various organs which make of an active man one of the strongest animals in creation; chemical affinity under a thousand diffierent forms, with the very complex series of. combinations and decompositions, assimilations and secretions, &c.; evidently, this is not only the correlation of physical forces, it is also their homogenesis, their mutual transformation, their identity in cause and also in nature, &c.

RENDERING TEXTILE FABRICS FIREPROOF.

The large number of casualties which are caused by the very combustible nature of the dresses of ladies, and other wearing apparel, has called the attention of eminent philosophers to provide a cheap and effective preventive against the same, and one of them—Mr. Doebereiner—publishes his ideas on this subject in a long treatise. After having given his advice, in cases of clothes taking fire, to avoid violent emotions, to lay down and to cover oneself up with quilts or anything of this kind that may be on hand, then he describes preventives. Substances have lately come into common use for wood and building materials, but for textile fabrics—which are generally made of flax or cotton—nothing has as yet been proposed which has been used to any extent to render them fireproof.

The principal preventives against the combustibility of textile fabrics, which have been proposed, are borax, alum, soluble glass and phosphate of ammonia. The three first named materials are equally good for coarse, combustible bodies, but they are not fit for the fine woven or knitted fabric. Borax, when it dries, puffs up under the action of the hot smoothing-iron, and it not only renders the fabric hard, but it also comes off in the form of dust. The same thing takes place with alum, which furthermore is liable to render fine textile fabrics brittle, so that they tear when subjected to a slight torsion. Soluble glass renders the fabric hard and brittle, and it acts to a certain extent on the fibers themselves, weakening the same, and causing the fiber to tear very easy.

Nothing of this kind takes place with the phosphate of ammonia. It leaves the fabric, after the same has been dried in the open air or by the hot smoothing-iron, sufficiently soft and pliable with the least effect on the fiber, and it may even be mixed with the paste used for starching. One ounce of this salt is dissolved in one quart of water, and the solution is applied to the fabric either by itself or mixed with the starch, and the fabric is afterwards dried in the open air or by the application of a hot smoothing-iron.

Careful housewives may make an experiment by saturating a worthless piece of linen or cotton cloth with phosphate of ammonia, and they will find that said cloth, on being held over the flame of a lamp or candle, will char after a certain time, but it will not burn except on some places, and then only after several minutes. If dresses, shirts and other articles of linen, cotton or paper, would be commonly treated with phosphate of lime, the danger arising from the catching fire of wearing apparel, bedclothes, &c., would be greatly lessened.

The principal difficulty thus far has been the high price of the phosphate of ammonia, and we will therefore point out several methods by which this salt can be produced in large quantities and at a comparatively small expense. It can be produced nearly pure by treating five parts of pulverized burned bones with three parts of sulphuric acid and twenty parts of water, and adding pure carbonate of ammonia, or it can also be produced from the liquid obtained in the manufacture of glue from bones by treating with muriatic acid. This liquid is neutralised by adding carbonate of ammonia, and after separating the precipitate from the liquid the latter is crystallized by evaporation. The mixture thus obtained of phosphate of ammonia and sal ammonia can be separated by repeated crystallization; but this operation can be dispensed with, as sal ammonia does not interfere with the effect of the phosphate of ammonia, and, to a certain extent, it enhances the quality of making the textile fabrics fireproof.

One ounce of this mixture can be produced for two cents, and when mixed with one quart of water, it will be sufficient for a large quantity of clothes.

[The above is translated from the Breslau (German) *Gewerbeblatt*, expressly for our columns, and the information should be extended far and wide. There is much scientific and practical information that is exceedingly useful, but is only applicable to certain trades and professions; but this is valuable knowledge for every household, and every female in the country should be acquainted with it. If the phosphate of ammonia were commonly employed in all households for treating outer garments made of textile fabrics, we would seldom hear of deaths from clothes taking fire.—Eds.

OUR NATIONAL PROGRESS.

At the period of the Revolution, our population did not exceed 3,000,000, and now it is nearly 30,000,000! In 1850, our total population was 23,191,876, and we had about 1,000 miles of telegraph in operation. The census will be again taken this year, and it is expected that our population will now number about 30,000,000. In this important particular, we have excelled, by rapidity of increase, all nations, whether ancient or modern. At the Revolution, we found but 13 States; but now we have 33 States and 7 Territories. Did mankind ever before witness such magical enlargement as this?

Our commerce, in 1791, was valued at $52,000,000 imports and $19,000,000 exports. In 1858, it amounted to the enormous sum of $282,613,150 in imports, and $324,644,421 in exports (specie included). Our exports of cotton alone—a product entirely new since the Revolution — reached the unprecedented value of $131,386,561.

Our common schools now educate 4,000,000 of individuals annually.

The geographical features of our country are as follows:—

	Miles.
Mean breadth of the United States from the Atlantic to the Pacific	2,480
Length from north to south	1,840
Land frontier	4,070
Sea coast	5,430
Lake shore	1,250
Navigation of the Mississippi and its tributaries	22.000
Public lands, worth (at $1.25 per acre)	$1,250,000.000
Manufactures and mining produce in 1850	1,013.336,463
Agricultural produce in 1850	1,600,000,000
Real and personal estate	9,000,000,000

The last three items have been largely increased since the census of 1850; and we think that one-fourth may be safely added to the totals. Our manufactures at that time employed 2,000,000 of persons, at an annual cost of $233,000,000 for labor.

Spheroidal Condition of Bodies.—M. Boutigny d'Evreux, the gentleman whose work on the "Spheroidal State of Bodies" has gained for him a well-deserved reputation, has just sent to the Academy of Sciences (Paris) a few words of objection to the limited manner in which this spheroidal state is viewed in many works on physics. M. Boutigny objects to the term *spheroidal state of liquids*, taken exclusively, as *solids* are likewise susceptible of taking it. Some solids, such as chloride of ammonium, bichloride of mercury, nitrate of ammonia, camphor, iodine, stearic acid, margaric acid, wax, suet, &c., pass directly to a spheroidal state without at first becoming liquid. If a piece of ice be made to take the spheroidal state, and be then thrown upon the back of the hand (in this experiment the product is partly in the spheroidal state and partly solid), one feels, at a very short interval, two very distinct sensations; first, that of a temperature of +208° (nearly that of boiling water), next, that of cold=32°. On operating upon larger quantities, and with the aid of a thermometer, these temperatures are easily determined.

Cleaning Glasses and Capsules.—There is often a difficulty in cleaning glasses or porcelain capsules to which organic matters have adhered and in course of time become so hard and dry that they resist all solvents. The following process will be found to answer in almost every case:—The spots to be cleaned are moistened with concentrated sulphuric acid, and powdered bichromate of potash is sprinkled upon the acid; the objects are then left standing for some hours (through the night) in a moderately warm place. All organic matters are by this means destroyed, with formation of sulphate of chromium, which may be removed by water with the residue of the acid.—*Dingler's Polytechnic Journal.*

Armstrong Guns.—Very great activity prevails in all the Britith arsenals and dockyards. The gun factories are at work night and day on a prodigious scale, forging Armstrong guns of all sizes, from 6 up to 100-pounders. It is expected that twelve hundred heavy guns will be ready this year. During the past nine months, forty complete batteries of field rifle artillery have been equipped for service, besides two hundred 40-pounders for navy uses.